DOSSIER ON COMPOSTING

KENYA INSTITUTE OF ORGANIC FARMING

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DOSSIER-COMPOSTING

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PART 1

INTRODUCTION TO COMPOSTING CONCEPT IN ORGANIC FARMING

What is Organic Farming?

Organic farming is a system in farming, which ensures balance of nature.

- It mainly entails recycling of natural resources.
- It discourages foreign inputs, which in one way or the other interferes with the natural cycle.

It aims at integration of crops and livestock thus it encourages biodiversity

What are the merits of Organic farming?

- Less input is required.
- Use of locally available resources thus less expensive.
- Improve soil structure e.g. fertility aeration ,water holding capacity
- Environmental protection.
- Holistic farming (considers every aspect of nature)

What are the main principles of Organic Farming?

1. Organic farming protects the environment and promotes good health for there is no contamination and use of synthetic chemicals.
2. Organic farming maintains long-term soil fertility by providing or encouraging biological activities.
3. Organic farming favors bio-diversity on every farm or production unit and it's surrounding.
4. Promotes recycling of organic matter from to production unit and back to the farm.
5. Creates conditions of animals' husbandry that promotes expression of natural behaviors.
6. Organic farming ensures that organic products are not contaminated with synthetic chemicals and residues from production to consumption.

PART 2

COMPOST MAKING

Cooposting is the natural process of turning organic material into"valuablg soil food called humus. On a farm, large amounts of vggetation such as **crop remains**, garden weeds, kitchen and household wastgs, hedge cuttings, garbage, etc. Are converted in a comrost pile into humus. When properly made and applied, compost becomes immediately available as plant food without the need to be first broken down by soil micro-organisms. When compost is applied, it does not cause excessive weed growth, as is sometimes the case with ordinary farm yard manure. This is because the process of making compost generates heat, which destroys the germinating power of weed seeds. By using compost, good crops can be obtained without the need to apply expensive chemical fertilizers

MATERIALS USED FOR COMPOSTING

- Livestock manure
- Ordinary top soil
- Wood ashes or charcoal dust
- Green vegetation materials
- Dry vegetation materials
- Dry crop remains without high levels of lignin
- Water
- Fungus Compost Activator-*Trichoderma harzianum*

PROCEDURE FOR MAKING VEGETATION COMPOST

1. Collect, according to the quantities below, the ingredients: plenty of plant material, both dry and green; some ordinary top soil; some animal manure or old compost; ordinary wood ashes and charcoal dust; and several jars of water.
2. Select a location close to the place where the compost will be used, and adequately sheltered from the wind, rain and sun. A compost pile must not get too hot or dry.
3. Measure out an area one-and-a half meters to two meters wide and any convenient length depending on the available composting materials. It must be possible to work on the compost without walking on it.
4. Loosen the ground where the compost pile will be. The materials need close contact with the loose soil at the bottom. It is best to make a shallow trench about 30cm deep. In dry areas the trench or pit can be as much as one meter deep. The top soil obtained will be used in the compost. Therefore, put it on one side beside the trench.
5. Lay down the bottom layer, which should be rough vegetation such as maize stalks or hedge cuttings. This layer should be about 30cm thick. Material too long should be chopped up.
6. The second layer should be manure or old compost or slurry from a biogas pit. It should be about 10cm thick.

7. Next, sprinkle some top soil to generally cover the material. Do not put on too much soil. Use only top soil.
8. The next layer should be made up of green vegetation about 15-20cm thick. Use green weeds, grass, hedge cuttings or kitchen waste.
9. If you have wood ashes, sprinkle some on top of the green vegetation. If wood ash is not available, use top soil.
10. Then water the whole pile well. You may use a watering can or any other convenient container but make sure the pile is well watered.
11. Repeat the process starting with rough vegetation then manure or old compost, top soil, green vegetation, ash or soil and finally water again.
11. Build the pile to a height of one to one-and a half meters. A well made pile has almost vertical sides and flat top. If you have a lot of materials, it is good to build in short sections two meters in length.
13. To complete the pile, cover it all over with 10cm of topsoil. This layer prevents gases from escaping the compost pile. Lastly, cover the whole pile with dry vegetation to prevent loss of moisture through evaporation.
14. Take a long, sharp, pointed stick and drive it into the pile at an angle. After two to three days, decomposition will have started in the pile. The stick, when removed, will show fungus called “fire fang” which destroys the compost when the pile becomes too dry inside.
15. The pile must be watered occasionally, about every third day depending on weather conditions. If it is raining there is no need to water. If “fire fang” develops it is best to add water and turn the pile.
16. When all goes well, the pile should be turned after three weeks. Do not add any fresh material during turning except water where “fire fang” has developed make sure that while turning the bottom part of the pile becomes the top of the new pile. This is necessary because rotting at the bottom goes slower than at the top.
17. After three more weeks the pile should be turned a second time. The pile should stay moist, not wet. When the pile has been taken care of well, there is no need for further turning. By now the compost should have a fresh earth smell and no grass, leaves or animal droppings should be visible. Some woody branches or stalks may still be present as they take a long time to rot.

Three weeks after the second turning, the compost should be ready for use. If the planting season is still far away, leave the pile where it is. Keep it well covered and moist. There is a big difference between moist and wet. Compost is wet when water drips-out of a handful which is squeezed tightly. Avoid this. The pile should always be kept covered with dry material. Remember, compost should be moist, **not**

wet!!

PROCEDURE FOR MAKING BOMA COMPOST

When a farmer keeps animals, there is usually a *boma* on the farm. In order to keep the animals clean, bedding is put in the *boma.* It is advisable to add new bedding once a week, and enough so that all urine is soaked up. Anything that can rot can be used as bedding. It can be maize stalks, weeds, grass, leaves, sawdust, ashes, etc. A mixture of materials is best. Bedding soaks up urine and droppings, which are very rich plant food, and prevents losses through leaching or drying out in manure. The farmer who puts new bedding regularly will make plenty of high quality compost.

Well-mixed manure can be taken out either every day or once a week. If taken out daily, the mixture should be put in a pile and a small amount of soil spread on top each day. This can be continued until there is enough material to build a boma compost, which is done as follows:

1. Each time manure is taken out of the *boma*, it should be composted immediately. Sheep, goat, rabbit and chicken manure are all rich manures. Because the bedding is plant material, there is no need to add more greens. It is practical to make the compost next to the *boma* to save effort moving the manure and used bedding.
2. Like on the drawing, a trench of 30cm in depth is dug out behind to *boma***.** The soil is put next to the trench. The bottom of the trench is loosened and a layer of dry vegetation is put on the bottom.
3. Then a layer of about 10cm manure and bedding is thrown out of the *boma* into the trench.
4. This is covered by about five cm of soil.
5. Again a layer of about 10cm manure is added and again covered by soil. This goes on until the compost pile is completed.
6. In the dry season the manure will need watering. During the rains the manure will be very wet. When this is the case, keep the pile low (about one meter). Dry manure can be piled about one-and-a-half meters high.
7. When finished, the whole pile is covered with soil and finally with grass, maize stalks or banana leaves to prevent drying up.
8. Make sure you use sticks to control the temperature because *boma* manure becomes very hot. Add water as son as the stick feels dry or becomes white.
9. After two or three weeks the piles is turned into the second trench and after two or three more weeks it is turned into the third trench.
10. The compost is stored until planting time in a big covered pile next to the third trench

PROCEDURE FOR MAKING TRENCH COMPOST

1. Dig trench 60cm wide and 60cm deep. The length can be any size, put the soil aside.
2. Spread a15cm layer of dry vegetation on the bottom of the trench.
3. Add an 8cm layer of cow dung or compost.
4. Add a 15cm layer of green vegetation.
5. Sprinkle wood ash on the top.
6. Repeat this layering process one more time (time pile will be above ground level).
7. Cover the top with dry vegetation to prevent moisture loss.
8. Crops are then planed along the edges of the trench.
9. in the next season, look for a new place to make the trench.

PROCEDURE FOR MAKING BASKET COMPOST

1. Dig circular holes 60cm in diameter and60 cm deep and put the soil aside or flatter it out between the holes.
2. Put a 15-cm deep layer of dry vegetation into the hole and spread an 8-cm layer of fresh manure (from cattle, sheep, goats, poultry or rabbits) on the vegetation.
    4. Add a 15cm layer of green vegetation.
5. Sprinkle wood ash on the top.
6. Repeat this layering process one more time (the pile will be above ground level).
7. Cover the top with dry vegetation.
8. Mark the circular outline of the pit with a round ‘basket” of slender sticks about 10cm in height and woven together.
9. Plant seeds or seedlings around the basket. The pile will gradually shrink in size.
10. In the next planting season, the compost baskets are established in a different area so that more of the *shamba* become fertile.

PART 3

CONVERSION RATES AND NUTRIENT LEVELS

During the composting process, some materials may decrease in terms of volume but overall resulting product by weight should remain relatively the same. Reduction by volume may result from compaction resulting from reduction of air spaces, settling of composting material and change in texture from course texture to fine texture after composting process. The right method of composting should ensure that there is no loss of volatile nutrients thro proper covering of compost sa well as preventing leaching of nutrients thro excessive moistening or run off during rains by erecting a shade to keep away the run off and digging a cut off drain to prevent flooding of the composting site during rains.

Nutrient levels of various nutrients depend on the type of materials used for composting. For example, when plant material used are high in protein content e.g. leguminous materials, then the nitrogen levels of the compost will be high. The same concept is used when comparing the use of the same leguminous materials when used as green material or dry material. Green material will result in higher yields of nitrogen as compared to dry materials.

Mineral nutrients will also depend on the age of plant materials being composted with older materials resulting in higher levels of mineral nutrients as compared to younger plant materials.

Such important mineral nutrients as phosphates can be added to the compost by sprinkling layers of rock phosphate granules during the setting out of compost heap at the right predetermined rates after nutrient analysis of ready compost using the same kind of plant materials on the compost heap.

Ready compost has about 16 important nutrients for replenishing soil fertility although their proportion may vary depending on the materials used during composting.

Incorporation of farmyard manure is to suitable in improving the nutrient levels of various soil nutrients and introduction of micro-organisms that aid composting process.

COMPARATIVE ANALYSIS OF COMPOSTING RICE STRAW AND BAGASSE

Rice straw and bagasse have very similar in terms of coarseness, cellulose and lignin levels that determine the rate of composting and release of bound nutrients in these materials. **KIOF** has not carried out specific research on Bagasse, but research carried out on composting of rice straw can be easily correlated to form a basis of bagasse composting.

To overcome the challenge of rapid composting of carbon-rich materials like bagasse, nitrogen rich materials like animal manure and a compost fungus activator-*Trichoderma harzianum* are used to compliment the soil microbes as cellulose decomposer ensuring that the compost can be used as soon as possible.

Ordinary composting requires two to three months for complete decomposition of regular vegetative materials but may take longer than that if carbon-rich material like bagasse is used as the primary composting material just like rice straw.

Animal manure may be difficult to obtain in sufficient quantities in which case it can be replaced with leguminous plants like Lucerne and Sesbania. The right proportion of using these nitrogen rich materials to aid carbon rich material decomposing is one part nitrogen to three parts carbon in a compost heap.

THE COMPOSTING PROCESS OF RICE STRAW AS A GUIDELINE TO BAGASSE COMPOSTING

- Dry rice straw is soaked overnight in water or in rain until it is saturated
- A simple platform of raised soil is made relative to the amount of rice straw to be composted
- A layer of rice straw 10-15cm thick is loosely piled on the platform
- On top of the layer, one or two handfuls of the activator is broadcast
- Straw is alternately layered with activator until all straw has been used
- Manure and/or leguminous plants are put on the top of the alternate straw and activator layers at rate of 15-25% of total composting materials
- The compost heap is then covered with plastic sheeting for 25 hours to allow heating up and activation of composting microbes.
- The compost heap is left unturned for one month to mature and be ready for use.
- It is considered to be ready when it has cooled and shrunk to about ⅓ of its original size
- Cooling marks the end of composting process when decomposing microbes have worked on the whole substrate

ANALYSIS OF NUTRIENTS IN RICE STRAW COMPOST

Raw rice straw before composting;

COMPOSITION	%
Cellulose	**37-41%**
Lignin	**13-14%**
Total nitrogen	**0.8%**
P2O5	**0.25-0.4%**
K2O	**0.3-1.6**
SiO2	**6-12%**
Carbon/Nitrogen	**7:3**

ratio	
PH	**6.9**

After composting;

Nutrient	**Percentage composition of the nutrient**
Nitrogen	**0.4%**
Phosphate	**1.6%**
Potash	**1.7%**
Magnesium oxide	**0.2%**
Iron	**430ppm**
Zinc	**68ppm**
Copper	**103ppm**
Boron	**6ppm**
PH	**6.4-7.2**

The usual deficiencies in a rice field are nitrogen, phosphorus, potassium and sometimes silica. It will be important to identify the common deficiencies in sugar cane fields in order to establish whether the bagasse compost should be fortified with these nutrients from other natural sources like rock phosphates to make the compost suitable for use as a complete alternative to inorganic fertilizers.

APPLICATION RATES OF COMPOST IN FIELD CULTIVATION

The recommended rate of compost application in field cultivation is 10 tons per hectare for most crops. In Malaysia, the effectiveness of compost application in sugarcane fields is measured by determining the sucrose levels of the crop instead of using tones of sugarcane produced per hectare and this has been shown to prove that compost is more effective in increasing the levels of sucrose in cultivated crops.

The main reasons of using compost as a soil fertilizer are;

- To supply nutrients in form of organic matter, humus which improves fertility of the soil
- Improve soil texture both physical and chemical
- Improve vitalization of micro organisms in the soil
- Improve absorption capacity of phosphorus by the soil
- Promote crop growth
- Develop aggregated soil structure to enhance water absorption and retention capacity.

Inorganic fertilizers may not be able to impart all these benefits to the soil by their regular use which mainly leads to deterioration of soil structure and destruction of important soil micro organisms.

QUALITY CONTROL IN COMPOST

It is important to avoid introduction of weeds and pests to the fields through the use of compost. Proper farm hygiene should be exercised to ensure that materials that may harbor pests and diseases are properly sterilized or eliminated altogether during the collection of required materials.

The right methods and procedures should be used to make sure that a good quality compost results after the composting process. Control of temperature and moistening during the composting process are some of the methods used in quality control of compost.

Dead animal bodies and human waste are not recommended for use in compost making due to public health concerns that may arise from use of such materials. The cultures of most communities also discourages handling of human waste.

COST ELEMENTS AND SUBSTITUTABILITY WITH INORGANIC FERTILIZERS

Compost making uses locally available plant materials to make a viable organic fertilizer. Some of these materials are considered to be solid waste that may pollute the environment and compost making serves the dual purpose of making affordable organic fertilizer as well as cleaning environment of solid waste that may constitute nuisance-also known as solid waste management.

A kilo of ready dry processed compost when packaged in 60kg bags costs Ksh 20.00 or Ksh 1200.00 per bag.(Egerton University Organic Fertilizer Project). This compares well with inorganic fertilizers that sell at about Ksh 3000.00 per 50kg bag.

When all the above facts are considered, use of compost as fertilizer is beneficial in terms of cost and environmental conservation as well as sustainable recycling of soil nutrients when compared to the use of inorganic fertilizers.

CONCLUSION

While there is no specific research done on bagasse composting, this composting dossier offers a guideline and reference point in composting of bagasse.

KIOF is ready to carry out the specific research on composting of bagasse as it has capacity and experience along this line of research.

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